

Children's Lie-Telling and Self-Awareness as an Honesty Promoting Technique

By

Jasmine Bender

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## Abstract

The present study investigated how social-cognitive development relates to children's lie-telling and the effectiveness of a novel honesty promoting technique (i.e., self-awareness). Sixty-four children were asked not to peek at a toy in the experimenter's absence and were later asked about whether they had peeked as a measure of their honesty. Half of the children were questioned in the self-awareness condition and half in the control condition. Additionally, children completed a battery of cognitive and social-cognitive tests to assess executive functioning and theory-of-mind understanding. While first-order theory-of-mind understanding, inhibitory control, and visuospatial working memory did not significantly relate to children's lie-telling, measures of inhibitory control in conjunction with working memory and complex working memory were significantly related to children's lie-telling. Finally, the novel honesty promoting technique was effective: children in the self-aware condition lied significantly less often than children in the control condition.

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## **Introduction**

Everyone tells lies, even children (e.g., DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996; Talwar & Lee, 2008). Lie-telling refers to an individual intentionally making a statement that they themselves (i.e., the lie-teller) believes to be untrue. Talwar and Lee (2008) proposed a developmental model of lie-telling in children. Very young children, 2- to 3-year-olds, are suggested to make primary lies. These lies are deliberately untrue statements that do not necessarily take the mental state of a listener into account (i.e., wishful thinking). Between the ages of 4- and 6-years, children progress and begin telling secondary lies, or lies that take into account the listener's mental state. That is, children now can understand that if the listener is unaware of the true state of affairs, they can instill a false belief in their mind. Beyond this stage, children enter the tertiary lie stage; here, they have the capability of concealing the fact that they have told a lie by maintaining consistency across their statements. The present study focuses on children between the ages of 3- to 6- years and the secondary lie stage, and is therefore examining children who can intentionally make statements they believe to untrue. Moreover, lies are often categorized as either antisocial or prosocial. Antisocial lies are told for self-serving purposes, such as to conceal a transgression or avoid punishment. Alternatively, prosocial lie-telling is told without the intent of harm, and is used to maintain amicable relationships. The present study will be focusing specifically on children's antisocial lie-telling.

Although children can tell lies, lie-telling is a complicated social process that they need to navigate their way through. The complication arises because adults' responses to children's lies can be paradoxical. On one hand, children are told that lying is morally wrong and can result in negative consequences, such as punishment. On the other hand, if children's lies go undetected, allowing them to successfully



conceal a transgression, lie-telling is implicitly encouraged. This inconsistent punishment and reward system makes it difficult for children to discover when they should or should not tell a lie. Not only is it difficult for children to understand when it is beneficial for them to lie, children also have to become cognitively mature enough for the act of lying (e.g., Evans & Lee, 2011; Evans & Lee, 2013; Talwar & Lee, 2008). For example, social-cognitive and cognitive skills relate to children's ability to tell and maintain lies. Though there has been evidence that certain skills such as inhibitory control, working memory, and theory of mind relate to lie-telling, the individual contribution of these skills to lie-telling is currently unclear.

Despite the positive aspects to lie-telling (e.g., showing that children are developing cognitively), lie-telling is a behaviour that is viewed as being morally wrong (e.g., Bok, 1989) and thus honesty promotion is important. For example, lie-telling can have a negative impact on social relationships by damaging trust and reducing the quality of relationships with others (DePaulo & Kashy, 1998; DePaulo et al., 1996; Evans & Lee, 2014; Schweitzer, Hershey, & Bradlow, 2006). Furthermore, when it comes to children telling lies within the legal system they could potentially be put at risk. For example, if children lie about an abusive situation, such as denying that abuse has actually occurred, they could be kept in danger due to their deception. So, promoting honesty in childhood is not only necessary for social relationships, but it can also help protect individuals in the court system.

My thesis will examine how social-cognitive and cognitive development relates to moral development by examining moral (lie-telling) as well as social-cognitive and cognitive (theory of mind and executive functioning) development in action through children's lie-telling behaviours. Specifically, this study will look at

children's lie-telling, a novel method for promoting honesty, and how social-cognitive and cognitive development relates to both of these factors.

### **Children's Understanding of Truth and Lies**

With age children become better at categorizing truths and lies, transitioning from a focus on the factuality of a statement to the actual intention of the speaker when determining whether a statement is a lie. Children begin categorizing truths and lies in their preschool years. Although their understanding of these categories starts early, it is quite rudimentary (Talwar & Crossman 2011). Young children view lies rather concretely defining them in a rule-based manner assuming anything said that is untrue, regardless of intention, is a lie (Peterson, Peterson & Seeto, 1983; Strichartz & Burton, 1990). This concrete view of lying is based on young children's reliance on the factuality of a statement (i.e., whether the statement is correct or incorrect) in determining whether a statement is a lie. For example, children even categorize individuals giving incorrect directions by accident as lie-tellers, failing to take intention into consideration (Peterson et al., 1983). Their categorization does become more sophisticated with age, and by 11 years children begin to rely on the intention of the speaker to decide whether statements are lies (Strichartz & Burton, 1990). Taken together, we see that children's understanding of categorizing lies moves from being concrete and inflexible to being more abstract and flexible with age.

Like their categorical understanding of truths and lies, children's moral evaluations of truths and lies also develops with age, starting with an outcome focus (i.e., punishment) then transitioning to an intention focus (i.e., lies are morally bad, and truths are morally good). For example, though preschool-aged children judged lies more negatively than truths, they also judged lies that were punished as worse than lies that were not punished (Bussey, 1992). Thus, preschoolers not only ignore

the intention when categorizing a lie, they also ignore intention and solely focus on the outcome of a lie (i.e., consequence of punishment or not) when morally evaluating it. However, by age 7 children stopped using punishment as a basis for morally evaluating lies. Thus, they viewed lies that are punished and not punished similarly, as they have begun to take the intention of behaviour into consideration for their moral evaluations. These findings demonstrate that while preschool-aged children have an understanding that lies are worse than the truth, they do not develop a comprehensive understanding of lies regardless of punishment until middle childhood.

Although more rudimentary than older children, even young children understand what a lie is and that it is morally wrong to tell lies; despite this understanding children still lie. For example, Talwar, Lee, Bala and Lindsay (2002) examined children's conceptual knowledge about truth and lies and how it related to their actual behaviour. Conceptual knowledge was assessed with stories about a child who transgressed (e.g., a child ate a candy she was told to not eat) and denied that transgression. Children were asked whether what she said was the truth or a lie and whether it was good or bad. In addition, they were asked whether they would confess to that transgression if it was them in that situation. Children also participated in a *temptation resistance paradigm* in which they were given an opportunity to transgress by cheating at a game (i.e., peeking at a toy they were asked to not peek at) in the absence of the experimenter. They were then questioned about their behaviour (see Methods for details; Lewis, Stranger & Sullivan, 1989) to assess their actual lie-telling behaviours. Although the majority of children correctly identified the untruthful statement as a lie and said that they would confess if they had been the one who transgressed, the majority of children also lied after peeking in the temptation resistance paradigm. That is, children's responses were not significantly related to

their actual truth- and lie-telling behaviours. Nonetheless, this type of reaction is not surprising: if children state that they would not transgress it makes them appear morally good. Similarly, lying about a transgression they themselves have committed (i.e., saying they did not transgress, even though they did) also makes them appear morally good, if the lie does not become discovered. Thus, children are giving socially appropriate responses in the given scenarios. This type of behaviour is not unique to children. In fact Jensen, Arnett, Feldman and Cauffman (2002) showed that approximately 60% of college students cheated using someone else's homework in the previous year, despite the moral wrongness and academic penalties set in place to deal with cheating in colleges. Though children understand lie-telling is bad, they still do it, even at a young age, because they want to appear morally good. In doing so, if children transgress they need to learn to lie to hide transgressions as to stay out of trouble.

### **Developmental Foundation of Lie-Telling**

Not only does children's understanding of lies develop with age, but their lie-telling behaviours do as well: children begin lying with increased frequency over the preschool years, and after age 6 they become sophisticated in their ability to conceal their lies. There are two main components of lie-telling: initial lie-telling behaviours (the decision to lie) and semantic leakage control (concealment of lie). First, when asked a question, children need to decide whether or not to actually tell a lie: their initial lie-telling behaviour. This decision to lie begins to emerge in children around 2 years of age (Newton, Reddy, & Bull, 2000; Wilson, Smith & Ross, 2003). The frequency with which children will tell lies to conceal a transgression increases with age (Lee, 2013). For example, at the age of 2 few children tell lies to conceal their transgression (approximately 30%), whereas by 4 years of age the majority of

children lie (between 70-80%). After 4 years of age, lie-telling rates stay relatively stable into middle childhood. Children also become more sophisticated in their ability to successfully lie with age. In particular, young children will often leak information that gives away the fact that they have lied (Talwar & Lee, 2008). This is known as semantic leakage. By 6 to 8 years of age children begin to control this leakage, demonstrating semantic leakage control, the second component of lie-telling. That is, after children decide to lie they need to conceal the leakage of information that reveals their transgression and initial lie by maintaining consistency across statements. This makes their lie-telling harder to detect. A common method for examining children's lie-telling behaviours is the *temptation resistance paradigm* (see Methods for details; Lewis, et al., 1989) which allows for children to lie naturally and spontaneously. The current investigation specifically examined children between the ages of 3 and 6 years; since children do not start demonstrating semantic leakage control abilities until after age 6, for purposes of this thesis I will only be focusing on the initial lie-telling component.

Due to the steep increase in children's initial lie-telling behaviours from age two to four, a theory has been proposed to explain the developmental increase: the ToM<sub>1</sub> Hypothesis (Polak & Harris, 1999; Talwar & Lee, 2002). This theory posits that first-order false-belief understanding is required to tell a lie. First-order false-belief understanding refers to the ability to identify that you possess knowledge that can be different from another person's knowledge. According to the ToM<sub>1</sub> Hypothesis you must understand that someone else can have different knowledge than you, so you have the ability to instill a false belief in their mind. Few studies have directly tested the ToM<sub>1</sub> Hypothesis, and the results have been inconsistent (Evans et al., 2011; Polak & Harris, 1999; Talwar & Lee, 2008). Specifically, Talwar and Lee (2008) had

children complete both the temptation resistance paradigm and a measure of first-order false-belief understanding. In support of the ToM<sub>I</sub> Hypothesis, these researchers found that children who had higher first-order false-belief scores were more likely to tell lies than children with lower first-order false-belief scores. Polak and Harris (1999) also found support for the ToM<sub>I</sub> Hypothesis with children between the ages of 3 and 5 in Experiment 2: children who had higher first-order false-belief scores were more likely to tell lies than those with lower scores. On the other hand, Polak and Harris (1999) did not find a significant relation between false-belief scores and 3- to 5-year-olds' decisions to lie in Experiment 1. Additionally, Evans and colleagues (2011) did not find a significant relationship between 4-year-olds' false-belief understanding and their decision to lie. Consequently, what role theory-of-mind has on children's initial lie-telling behaviours is unclear. Given the inconsistencies, the present study aimed to not only address the ToM<sub>I</sub> Hypothesis by examining how first-order false-belief relates to the development of children's initial lie-telling behaviours, but it also aimed to examine the impact of theory-of-mind on a novel honesty promoting technique (see below).

Whereas the ToM<sub>I</sub> Hypothesis focuses on a social-cognitive perspective to lie-telling, another theory, the Activation-Decision-Construction Model (ADCM; Walczyk, Mahoney, Doverspike & Griffith-Ross, 2009) attempts to explain the increase in lie-telling across the preschool years in relation to cognitive development (i.e., executive functioning skills such as working memory and inhibitory control). The ToM<sub>I</sub> Hypothesis and the ADCM are not mutually exclusive theories, as they are examining different aspects of development that are related (e.g., theory of mind and executive functioning). The ADCM has three components: activation, decision and construction (See Figure 1). According to this theory, when a

question is asked (e.g., Did you peek at the toy?) it automatically activates the truth in the long term memory store, priming semantic and episodic memories as the truth is transferred from the long term memory system to the working memory system (which refers to a temporary holding and processing system in the mind; Baddeley, 1986). This is the Activation component. Working memory must then hold the activated truth. Next, the Decision component comes into play as the decision to either tell the truth or a lie is made. If the decision is made to tell the truth, the truthful statement currently held in the working memory system is simply made. However, if the decision to tell a lie is made then the third component, Construction, is initiated. Here, the truth that is currently held in working memory is then processed and manipulated within the system to provide an alternative response—a lie. Thus, this requires processing above and beyond the working memory demands of simply stating the truth (i.e., merely temporarily holding the truth information). Additionally, when giving the dishonest statement, the truth also needs to be inhibited. Thus, in testing this model two hypotheses are proposed. First, it is proposed that working memory will relate to lie-telling because children would have to manipulate the truth that is currently held in working memory to construct a lie based on the truth (which should involve rehearsal as well as processing of information within working memory). It is also proposed that working memory and inhibitory control will collectively predict lie-telling: working memory to hold the activated truth memory as well as the lie, and inhibitory control for inhibiting the truth when stating the lie.

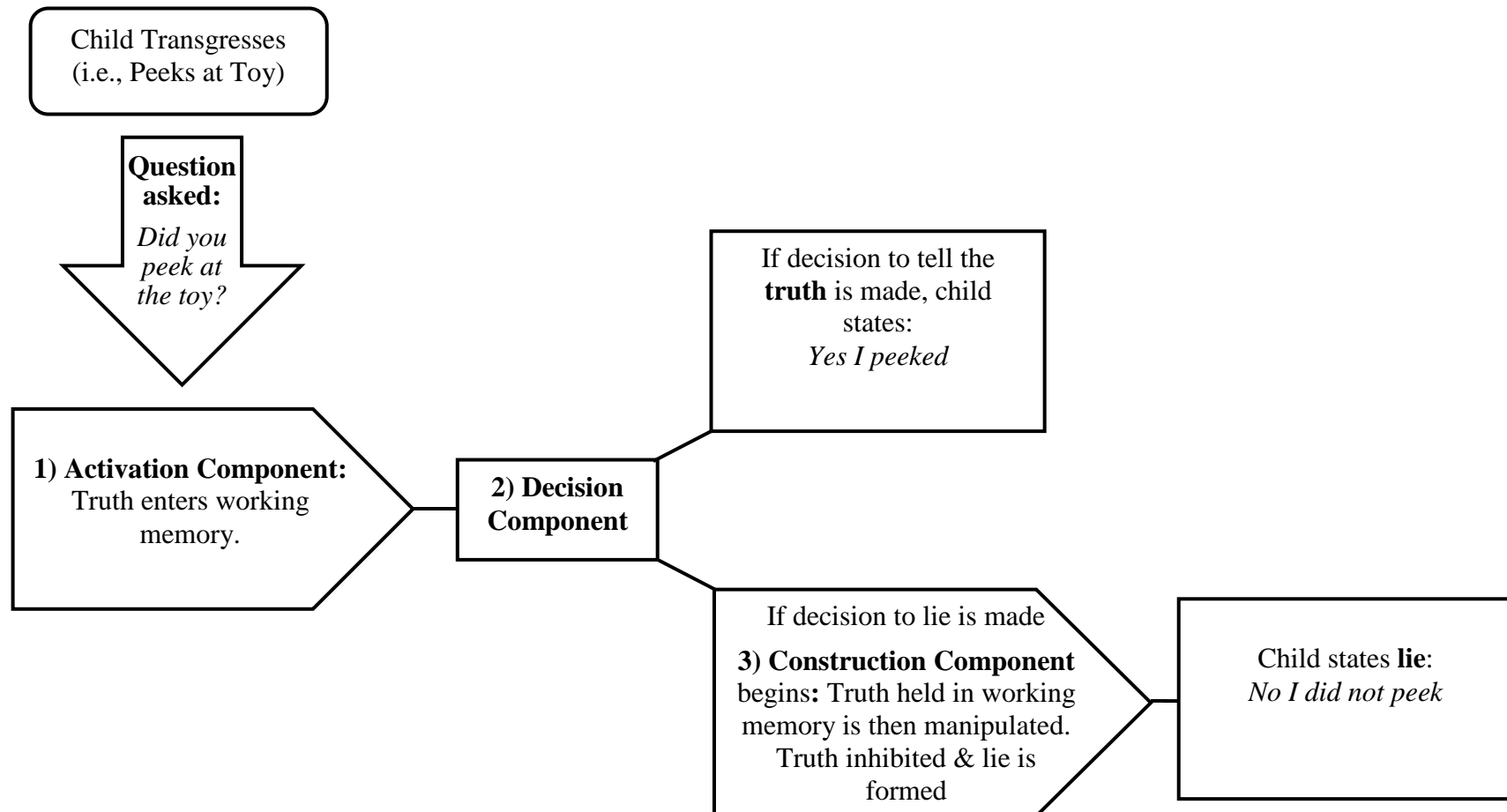


Figure 1. A model of ADCM for children's lie-telling about a transgression (based on Walczyk, et al. 2009)



Although some studies have examined executive functioning skills and how they relate to the development of children's lie-telling, how inhibitory control and working memory alone, or in conjunction, contribute to lie-telling is not clear. Currently literature that has examined working memory in terms of lie-telling suggests that working memory and lie-telling are not related. For example, Talwar and Lee (2008) examined working memory in relation to 3- to 8- year-old children's lie-telling using the Six Box Scramble task (Diamond, Prevot, Callender, & Druin, 1997; see Methods for details). Children's performance on this working memory task was not significantly related to their lie-telling behaviours in the temptation resistance paradigm and these researchers concluded that working memory does not relate to children's decision to lie. Additionally, Evans and Lee (2011) examined the relation between 8- to 16-year-old children's lie-telling and working memory using the Backward Digit Span. Similar to Talwar and Lee (2008) they did not find that working memory was significantly related to older children's decision to lie.

Although no significant relationship between working memory and lie-telling was found in either study, there could be methodological explanations for this. To start, little is known about how different components of working memory relate to lie-telling. Talwar and Lee (2008) might have used a working memory measure that assesses an aspect of working memory that may not relate to lie-telling. For example, the working memory system can be broken down into four subsystems: the phonological loop, the visuospatial sketchpad, the central executive, and the episodic buffer (Baddeley, 1986). The phonological loop refers to the phonological short term storage system which is also responsible for subvocal rehearsal. The visuospatial sketchpad stores visual and spatial information. The central executive is responsible for processing information as well as

regulating attention, action, and problem solving in both the phonological and visual systems. Finally, the episodic buffer is responsible for transferring information from the working memory store into the long-term memory store. Talwar and Lee's (2008) working memory task, the Six Box Scramble, relies on visuospatial processing; children need to remember which of the six coloured boxes they've already opened to find each sticker inside the boxes which were scrambled after each trial. Young children often have difficulty with transferring visuospatial details to the phonological loop via rehearsal (e.g., Hitch & Halliday, 1983; Hitch, Halliday, Schaafstal, & Schraagen, 1988). Thus, when completing the Six Box Scramble task, young children rely solely on their visuospatial working memory system. The fact that no relationship was found between this visuospatial task and lie-telling is not surprising given that telling a lie in the temptation resistance paradigm is verbal behaviour which should not rely on visuospatial processing of information.

Alternatively, Evans and Lee (2011) used a different measure, the Backward Digit Span, which is suggested to involve both the central executive (to process information) and the phonological loop (to rehearse information processed by the central executive; Baddeley & Logie, 1999). It has been suggested that complex working memory measures are those that tap into the central executive and phonological loop exclusively. According to the ADCM (Walczyk et al., 2009), complex working memory should relate to lie-telling because to tell a lie you need to hold the truth in the working memory store, which should involve rehearsal (i.e., phonological loop) while constructing a lie, which should involve processing the truth to make up a lie (i.e., central executive). Evans and Lee (2011) did not find complex working memory (as measured by the Backward Digit Span)

to be significantly related to the decision to lie in older children. However, by the age of 8 children have met the minimum requirement of executive functioning skills necessary for the decision to lie, so all children are capable of doing it (e.g., Evans & Lee, 2011; Talwar & Lee, 2008). Nonetheless, they do not necessarily have the executive functioning requirements to complete the second part of lie-telling, semantic leakage control, successfully. In fact, Evans and Lee (2011) found that semantic leakage control was significantly related to complex working memory. Thus, because young children have not yet met the minimum working memory requirements for the initial decision to lie, complex working memory should be related to younger children's decision to lie. Taken together, the present study aims to examine both visuospatial working memory and complex working memory in relation to the decision to lie to assess whether specific types of working memory are related to children's decision to lie.

Another executive functioning skill whose contribution to lie-telling is currently unclear is inhibitory control. Inhibitory control refers to the ability to control your behaviours and thoughts by suppressing a prepotent response and instead providing a more appropriate or alternative response (Diamond, 2013). Some researchers have suggested that inhibitory control tasks have varying reliance on working memory, with some tasks requiring more working memory than others (Carlson & Moses, 2001). For example, some tasks involve simply inhibiting a response (e.g., Simon Says like tasks), which has low dependence on working memory, whereas other tasks involve action of a conflicting or alternative response (e.g., Stroop), which places higher demands on working memory. According to the ADCM (Walczyk et al., 2009), inhibitory control tasks that rely more heavily on working memory should be related to lie-telling as

working memory is needed to hold the activated truth memory, as well as the lie, at the same time that inhibitory control is suppressing stating the truth.

It has been suggested that inhibitory control Stroop-like tasks are working memory dependent as they require children to remember and inhibit their dominant response while producing a conflicting response (Evans & Lee, 2011; Evans & Lee, 2013; Talwar & Lee, 2008). Consistent with the ADCM, studies have shown that Stroop-task scores relate to children's decision to lie about a transgression, at least in younger children. Evans and Lee (2013) used the Shape Stroop task, a non-verbal Stroop task, with 2- to 3-year-olds. Children were shown pictures of two large fruit with small fruit embedded in the centre of them. Children were told that they should always point to the small fruit. For example, in a "banana trial" there would be a large banana with a small apple inside of it beside a large orange with a small banana inside it. To be correct, children would need to inhibit their prepotent response of pointing to the bigger banana, and instead point to the small banana. Children were found to be significantly more likely to lie with increased performance on the Shape Stroop task. Similarly, Talwar and Lee (2008) used the Day/Night Stroop task, a verbal Stroop task (see Methods for details) with children aged 3 to 8 years and found that children who had lied about peeking at the toy during a temptation resistance paradigm had higher Day/Night Stroop scores than children who had confessed to the transgression. Evans and Lee (2011) examined 8- to 16-year-olds' Word/Colour Stroop task scores in relation to lie-telling behaviours. The Word/Colour Stroop task involves children being shown colour words (e.g., Blue, Red, and Green) printed in an opposing ink colour and asking them to say the colour of the ink out loud. Thus, children needed to inhibit the automatic response of reading the word and

suppress it while simultaneously stating the ink colour. Additionally, an age-modified temptation resistance paradigm was used to assess their lie-telling behaviour. Results revealed that the Stroop-task was not significantly related to children's decision to lie; however, it was related to their semantic leakage control abilities. Again, it seems then that younger children have not yet met the minimum requirements for inhibitory control and working memory skills needed for the decision to lie, so the decision to lie is a difficult feat. Alternatively, older children have better inhibitory control and working memory skills, and have met the minimum requirements necessary for the decision to lie by 8 years of age (see Evans & Lee, 2011; Talwar, Gordon, & Lee, 2007; Talwar & Lee, 2008). Nonetheless, not all older children have the skills necessary to demonstrate semantic leakage control. Thus, inhibitory control and working memory collectively might be related to children under the age of 8 years' decision to lie.

Although Stroop tasks are purported to tap into both inhibitory control and working memory skills, it is unclear whether one or both of these skills are driving the relation between the Stroop task and lie-telling. This is because no study has used a Stroop task alongside tasks that solely measure working memory and solely measure inhibitory control to assess their individual or combined contributions. Although it is difficult to find a measure of inhibitory control that does not require the use of working memory, there are measures that are proposed to require less working memory (e.g., Diamond, 2013).

Lie-telling is proposed to require both inhibitory control and working memory (e.g., ADCM; Walczyk et al., 2009) because children need to hold the truth in working memory, provide an alternative statement (i.e., a lie), while simultaneously inhibiting the

truth. Given this, it is hypothesized that tasks solely measuring inhibitory control (i.e., merely suppressing a response) should not relate to lie-telling: children should need to not only suppress a response (i.e., the truth) but also provide a conflicting response (i.e., the lie). Thus, it is expected that inhibitory control will not relate to children's lie-telling unless in combination with working memory. Furthermore, it is expected that complex working memory, composed of the central executive and phonological loop, will be related to the decision to lie. However, because working memory on its own is expected to be related to lie-telling, working memory could end up driving the relationship between the combination of inhibitory control and working memory with lie-telling.

### **Honesty Promotion Research with Children**

Lie-telling is a natural and normative behaviour that we all do (e.g., DePaulo, et al., 1996; Talwar & Lee, 2008). Given that it is normal, there is a positive side to lie-telling, as it shows that children are advancing in their social-cognitive and cognitive development (Evans & Lee, 2011; Evans & Lee, 2013; Talwar & Lee, 2008).

Nonetheless, lie-telling can have negative social implications. For example, in social relationships lying damages trust (DePaulo & Kashy, 1998; DePaulo et al., 1996; Evans & Lee, 2014; Schweitzer, et al., 2006). Thus, promoting honesty is a necessity in building healthy social relationships. Additionally, promoting honesty has practical implications ranging from morality education programs for parents and teachers to applications within the legal system. For example, parents and teachers can be aided in their ability to provide morality education if they are aware of techniques and methods that promote honesty. Furthermore, when it comes to the legal system, there are large numbers of children testifying in court each year (e.g., 100,000 as estimated by Bruck, Ceci, &

Hembrooke, 1998) including children as young as 3 years of age (Bala, Lee, Lindsay, & Talwar, 2000). In addition, children are often the only witnesses to certain types of abuse cases, such as child sexual abuse; thus, accuracy of reporting is vitally important for both the safety and protection of the child as well as the accused. Despite its social and practical importance, only a limited number of studies have experimentally examined methods in promoting honesty in children (Lyon & Dorado, 2008; Lyon et al., 2014; Talwar, et al., 2002).

**Successful techniques.** There are only three types of successful honesty promoting techniques that have been experimentally examined to date: promising to tell the truth, reassurance, and putative confession (e.g., Lyon & Dorado, 2008; Lyon et al., 2014; Talwar, et al., 2002). One way to increase children's honesty is having children promise to tell the truth (Lyon & Dorado, 2008; Talwar, et al., 2002). Whether children completed a transgression alone (e.g., Talwar, et al., 2002) or with a confederate (Lyon & Dorado, 2008), simply asking children ranging in ages from 3- to 7-years to promise to tell the truth significantly reduced their likelihood of telling a lie compared to children who did not promise to tell the truth. Reassuring children that they will not get into trouble for telling the truth after they completed a transgression with a confederate also significantly reduced lie-telling rates (Lyon & Dorado, 2008). The reassurance and promising to tell the truth methods were not significantly different in their effectiveness. Finally, for the putative confession, an interviewer tells children that the confederate told them everything that had happened when they played with her, and the confederate wanted the child to tell the truth. Children who received the putative confession after completing a transgression with a confederate had reduced lie-telling rates. Although all

three methods were found to be effective, lie-telling rates are still fairly high (around 50%); thus, other techniques need to be explored.

**Self-awareness.** A novel method being proposed in the present investigation that may increase honesty is inducing self-awareness. Self-awareness refers to being internally focused; that is, aware of ourselves and how others perceive us (Duval & Wickland, 1972). Duval and Wickland (1972) proposed a theory of objective self-awareness that suggests by bringing ourselves to our own attention as an object, for example through the use of a mirror we can increase our self-awareness and self-evaluation.

Self-awareness could reduce lie-telling behaviours because it increases adherence to social norms in both children and adults (Beaman Klentz, Diener, & Svanum, 1979; Diener & Wallbom, 1976; Gino & Mogilner, 2014). For example, Beaman et al. (1979) conducted field studies to examine how self-awareness through use of a mirror affects transgressing in children and found that children who were self-aware and individuated (i.e., asked personal questions about themselves, such as their name, age and address) transgressed less often than children who were not self-aware. This finding has also been found in adults (Gino & Mogilner, 2014). When primed to think about money, and given an opportunity to cheat at a game, adults were more likely to cheat when they did not have a mirror in front of them vs. when they did have a mirror in front of them. These findings suggest that inducing self-awareness reduces transgression rates; however, it is currently unknown whether it is related to other moral behaviours and social norms, such as telling the truth.



Not only does self-awareness affect a moral behaviour (e.g., transgressing), it also leads to adherence to social norms for non-morally relevant behaviours. The majority of children become self-aware by the age of 20 months (Amsterdam, 1972; Rochat, Broesch, & Jayne, 2012). Additionally, once children become self-aware, they begin to reference themselves in terms of how others would perceive and evaluate them. For example, Rochat et al. (2012) had children play a game in which an experimenter tapped their stomach, shoulders, and foreheads. Unbeknownst to the children, when their foreheads were tapped a yellow post-it note was placed on them. Children were randomly assigned to two conditions: Classic and Norm. In the classic condition, children had the post-it note placed on their foreheads by the experimenter. In the Norm condition parents sitting in the room with the children and the experimenter put post-it notes onto their foreheads as well, making wearing a post-it note the norm of the room. Of the children who became self-aware through use of the mirror, almost all children in the Classic condition removed the post-it note when they noticed it on their forehead in the mirror. Alternatively, the majority of children in the in the Norm condition hesitated in removing the post-it note from their forehead. That is, children who became self-aware then also adhered to social norms: children who were made to feel like wearing a post-it note was the norm (Norm condition) adhered to the norm by hesitating in removing the post-it note. In contrast, children who were made to feel like it was an oddity to be wearing a post-it note on their forehead (Classic condition) had no hesitation in removing it. This suggests that through the use of a mirror children not only became self-aware, but also became aware of how others perceive and evaluate them and consequently acted in accordance with social norms. Taken together, studies suggest that children's moral

behaviours (e.g., transgressing by stealing candy; Beaman et al., 1979) are affected by becoming self-aware and that being self-aware is also related to adherence to social norms (Rochat et al., 2012). Thus, when self-awareness is induced, children should adhere to the social and moral norm of honesty and be less likely to lie than children who are not self-aware.

### **Present Study**

**Cognitive factors.** The present study investigated the development of lie-telling behaviours in children between 3 and 6 years of age. This age range was selected because up until the age of 6 the decision to lie is cognitively challenging for children, whereas older children seem to have the executive functioning skill requirements necessary for the decision to lie. Instead, semantic leakage control is difficult for older children as it is cognitively challenging for them. Thus, children over the age of 6 were not of interest for the present study. The current investigation predicted that, consistent with previous research, older children will be more likely to lie than younger children (Lee, 2013), as children develop better social-cognitive and cognitive skills (such as theory of mind and executive functioning) with age. Next, the current investigation examined the validity of two theoretical models: The ToM<sub>I</sub> Hypothesis and the ADCM by observing how social-cognitive and cognitive factors (i.e., theory of mind and executive functioning) relate to the development of children's decision to lie. Given that there are inconsistent findings in regards to the ToM<sub>I</sub> Hypothesis (Talwar & Lee, 2008; Polak & Harris, 1999), the present study aimed to explore this hypothesis further. In addition to examining whether first-order false-belief is related to lie-telling I assessed the interaction between theory of mind and self-awareness as an honesty promoting technique (see below).

In addition, while recent studies have begun to define the relationships between executive function skills and lie-telling (Evans & Lee, 2011; Evans & Lee, 2013; Talwar & Lee, 2008), it remains unclear whether it is executive functioning as a whole that is related to lie-telling, or whether individual factors are particularly important. The present study will address this through testing the ADCM with the use of five executive functioning tasks: three inhibitory control and two working memory. The inhibitory control tasks are thought to vary in their dependence on working memory. Alternatively, the working memory tasks have little reliance on inhibitory control, but examine different aspects of working memory: visuospatial vs. complex working memory (which requires both phonological loop and the central executive). In terms of working memory, it is expected that complex working memory rather than visuospatial working memory will relate to lie-telling. Talwar and Lee (2008) did not find a relationship between children's lie-telling and visuospatial working memory, which makes sense as processing or storing of visuospatial information should not be necessary for this form of lie-telling. Alternatively, complex working memory should relate to lie-telling as the ADCM suggests that to tell a lie you need to hold the truth in the working memory store, which involves rehearsal (phonological loop), while at the same time a lie has to be constructed by processing the truth to make up the lie (central executive). Furthermore inhibitory control alone should not relate to lie-telling, but it is predicted that children with better scores on inhibitory control tasks that are working memory dependent should be more likely to lie; this is consistent with the ADCM as well (Walczyk et al., 2009), as children would need to hold the contents of the truth and lie in their working memory while inhibiting the truth to produce the lie. Nonetheless, since it is also predicted that complex

working memory will relate to lie-telling, it is unclear whether working memory in general will be driving this relationship between lie-telling and the combination of working memory and inhibitory control.

**Self-awareness.** The present study examines moral development specifically by aiming to increase adherence to social norms of a moral behaviour (i.e., honesty) through inducing self-awareness. It is predicted that children in the self-awareness condition will tell lies less often than children in the control condition. Given that truth telling is an important social norm, and increased self-awareness appears to increase adherence to socially-valued norms (Beaman et al., 1979; Rochat et al., 2012), when made self-aware and asked about their transgression by an adult children should feel more obligated to tell the truth.

A further aim is to examine how theory-of-mind development relates to the adherence to social norms, as measured by honesty, when children are either self-aware or not. It is predicted that there will be a theory of mind by condition interaction, with theory of mind's relation to lie-telling being affected in opposite directions for each condition. Children in the control condition with higher first-order false-belief scores should be more likely to tell a lie, which is consistent with the ToM<sub>1</sub> Hypothesis (Polak & Harris, 1999; Talwar & Lee, 2002). Alternatively, children in the self-awareness condition should have increased social awareness and this self-awareness should increase their adherence to social norms (e.g., Rochat et al., 2012), such as honesty. Additionally, children with higher first-order false-belief scores specifically should have a better social understanding and be able to think about how their behaviour impacts others. Thus, once self-awareness is induced, children with higher first-order false-belief understanding

should be the most likely to act in accordance with the social norm of honesty and be less likely to tell a lie.

## Method

### Participants

Sixty-four children aged 3:0 to 6:10 years recruited via community advertisements in St. Catharines, Ontario, participated in this study. Four children were excluded ( $M_{age\ in\ months} = 43.00$ ,  $SD = 2.94$ ) due to fussiness and equipment failure. The final sample consisted of 64 children:  $M_{age\ in\ months} = 56.51$ ,  $SD = 14.08$ , males = 26. There were 23 three-year-olds, 16 four-year-olds, 10 five-year-olds, and 15 six-year olds who participated. Informed consent was gathered from all parents and oral assent was gathered from all children prior to testing.

### Materials and Procedure

**Lie-telling behaviour.** Children were tested individually in a small private room. Children began the session by completing a modified *temptation resistance paradigm* to assess their lie-telling behaviours (e.g., Lewis et al., 1989; Polak & Harris, 1999; Talwar & Lee, 2002). Children were invited to play a guessing game in which they were turned around on their chair so that their back faced the experimenter. They were asked to identify a toy that was placed behind them based on the noise it made (e.g., A toy cow “moos”). Two practice trials were conducted that were meant to be easy enough so that children could successfully guess the toys’ identities. Then, the experimenter told children that she needed to leave the room for a minute to grab something for their next game that she had forgotten in her car. She asked them to not turn around and peek at the toy while she was gone and then placed the target toy, an elephant, on the table and left the room. The elephant played an ABC jingle sound that was unrelated to its identity which made accurately identifying the elephant based on its noise impossible without

seeking. Hidden cameras were set up in the room to determine whether children peeked at the toy in the experimenter's absence. Children who peeked at the toy were classified as peekers, and those who did not peek were classified as non-peekers. After a 1-minute delay, the experimenter returned to the room to question children about whether they peeked at the toy while she was away. The experimenter was blind to children's peeking behaviour. Children were randomly assigned to either a heightened self-awareness condition ( $N = 31$ ,  $M_{age\ in\ months} = 57.35$ ,  $SD = 14.19$ ) or control condition ( $N = 33$ ,  $M_{age\ in\ months} = 55.73$ ,  $SD = 14.16$ ). In the self-awareness condition a mirror was placed at eye level between children and the experimenter so children could see themselves during questioning about the transgression. According to Rochat and colleagues (2012) children in the present study should all be capable of becoming self-aware. Those in the self-awareness condition were asked to point to parts of their face in the mirror (e.g., "Point to your nose in the mirror", "Point to your ears in the mirror"). They were also asked what their name was and what grade they were in. The experimenter then repeated their response back to them. The purpose was to focus the children's attention internally. Lastly, the experimenter asked children, "Can you see yourself in the mirror?" to ensure they were still looking in the mirror. By having children look at themselves in the mirror and turning their focus internally (i.e., asking who they are and what grade they are in) during questioning, children's self-awareness should be increased (Duval & Wickland, 1972).

In contrast, in the control condition the non-reflective side of the mirror faced children so they could not see their reflection during questioning. This group was asked to point to objects in the room (e.g., "Point to your chair", "Point to the books") so their

attention was not directed inwards; rather it was directed externally to objects in the room. This ensured children's self-awareness was not heightened in the control condition.

Next, all children were asked the target question: "*Did you turn around and peek at the toy when I was gone?*" Peekers who responded with a "yes" were categorized as truth-tellers and Peekers who respond "no" were categorized as lie-tellers. Non-peekers who respond "no" were categorized as truth-tellers. Based on previous studies (Polak & Harris, 1999; Talwar & Lee, 2002) we did not expect to have non-peekers respond "yes" to the target question, thereby falsely confessing to peeking at the toy. Children were also asked two semantic leakage control follow-up questions. The first was "*What do you think the toy is?*" If children answered this semantic leakage control question correctly (i.e., saying the toy was an elephant) they demonstrated poor semantic leakage control because they leaked information that gave away the fact that they had lied. Alternatively, if children feigned ignorance by giving an answer of "I don't know" or gave an incorrect answer (i.e., something other than an elephant) they demonstrated good semantic leakage control. The second follow-up question that was asked was "*Why do you think it is X?*". This question gave children the opportunity to come up with a plausible explanation for their answer to the first question, specifically if they answered the first question correctly by saying "elephant". For example, if children explained their correct answer to the first follow-up (e.g., by saying "I have a toy elephant that plays that song"), they demonstrated good semantic leakage control—even though they did not demonstrate it initially. However, for purposes of this thesis the follow-up questions were not analyzed because children do not begin demonstrating semantic leakage control abilities until after the age



of 6 (e.g., Talwar & Lee, 2008). All tasks after the temptation resistance paradigm were completed in a between-subjects randomized order.

**Theory-of-mind tasks.** Two first-order false-belief stories were displayed on a computer in PowerPoint as the experimenter read through them with children. The first story was a modified version of the Smarties task (Gopnik & Astington, 1988). A Smarties box appeared on the screen and children were asked Question 1: “What do you think is inside the box?” which was a control question to ensure children were paying attention to the story. If children did not pass this control question, they received a score of 0 on the story's first-order false-belief target questions. Children were then shown that there were crayons inside of the box and asked Question 2: “Before you looked inside, what did you think was inside of the box?” This was a target first-order false-belief question. If children's answer was Smarties, they received one point. If they indicated that something other than Smarties was in the box (i.e., crayons or something else) they did not receive a point. Children were then shown a picture of a cartoon child Max. They were told Max has never seen inside of the box before and asked Question 3: “What does Max think is inside the box?” This was the second target first-order false-belief question. It assessed whether children could correctly identify that Max has a belief that is mistaken. If children indicated Max would think Smarties were inside of the box they received one point. If they indicated something other than Smarties (i.e., crayons or something else) they did not receive a point. This task score ranged from 0-2 with a higher score indicating better first-order false-belief skills.

The next story participants saw was a modified Sally-Anne task (Wimmer & Perner, 1983). For this story, children saw Sally put a ball into a basket and then leave the

room. While she was out of the room another girl, Anne, moved the ball from the basket into a box. Children were then asked Question 1: “When Sally returns to get her ball, where will she look first?” This was a target first-order false-belief question examining if children were able to understand someone else can have beliefs different from their own. If they indicated she would look in the basket they received a point. If they indicated elsewhere (i.e., the box or somewhere else) they received no point. Next, they were asked Question 2: “Where does Sally think the ball is?” This was the second target first-order false-belief question looking at whether children were able to understand that someone can have a mistaken belief. If children indicated Sally thought the ball was in the basket they received one point. If they indicated elsewhere (i.e., the box or somewhere else) they received no point. The last two questions: “Where is the ball now?” and “Where did Sally put the ball in the beginning?” served as control questions to ensure children were paying attention to the story. If children did not pass these control questions, they received a score of 0 on the story's first-order false-belief target questions. For the Sally-Anne task, children received a score that ranged from 0-2. Higher scores indicated better first-order false-belief skills. Finally, a total first-order false-belief score was created with children's scores from the two tasks added together.

**Executive functioning tasks.** Children also completed a battery of executive functioning tasks.

***Inhibitory control tasks.*** Inhibitory control was measured with three tasks, thought to vary in reliance on working memory.

*The Day/Night Stroop task* (Gerstadt, Hong & Diamond, 1994). For this task children saw a series of pictures of either a sun or a moon; they were told to say “night”

when they saw a picture of a sun, and to say “day” when they saw a picture of the moon. This task is suggested to require both inhibitory control and working memory because children have to remember to inhibit their dominant response while producing a conflicting response. For example, children had to inhibit their natural response to the card (i.e., Saying “day” for the sun picture or saying “night” for the moon picture) while stating the opposite response. Children were given practice trials until they understood the rules and then they completed 16 test trials. Scores ranged from 0-16 and higher scores indicated better inhibitory control and working memory skills.

*Bear/Dragon task* (Reed, Pien & Rothbart, 1984). For this task, children were shown two puppets: a Bear and a Dragon. One character was claimed to be friendly, and one was claimed to be naughty. The role of the Bear and Dragon as being friendly and naughty was counterbalanced between participants. Children were told to do what the Friendly puppet said to do, but *not* what the Naughty puppet said to do. After a few practice trials that ensured children understood the task, ten requests in total were given: five from the Friendly puppet and five from the Naughty puppet (e.g., “Stick out your tongue”, “Clap your hands”). This task has been suggested to be an inhibitory control task that requires working memory as children need to remember and inhibit their dominant response (reacting to the puppet) while producing a conflicting response (not reacting to the puppet). Thus, children had to inhibit responding to the requests from the Naughty puppet and only respond to the Friendly puppet to be successful. Each time children responded correctly to the inhibition (Naughty) request they received one point. This task was scored out of 5 and higher scores indicated better inhibitory control and working memory skills.

*Delay of gratification task* (Mischel, Ebbesen, & Zess, 1972). For this task, children were presented with three different kinds of snack treats (e.g., marshmallows, chocolate chips, or cereal treats) and were asked to choose their favourite treat. Next, two of their favourite treats were put on one plate and ten of the same treats were put on a second plate, both of which were placed in front of children. The experimenter told children that she had to step out of the room again and that if they waited to eat the treats until she returned they would get the plate with ten treats. Children were asked to ring a bell that was placed in front of them if they could not wait for her to return; by doing so she would return early and they would only get the plate with two treats. Children were given practice ringing the bell to ensure they knew how to ring it properly if they wanted to do so. Children were then asked “What happens if you wait the whole time?”, “What happens if you cannot wait?”, and “What happens if you ring the bell?” to ensure they understood the instructions before she left the room. If children did not understand the rules, the experimenter repeated them until they did. The experimenter then stepped out of the room for 5 minutes (300 seconds), until children rang the bell, or until they began to eat the treats. This task measured how well children could self-regulate and perform inhibitory control. This task measured length of time children waited from 0-300 seconds. The longer children waited the better inhibitory control skills they had.

***Working memory tasks.*** Working memory was assessed with two tasks.

*Six box scramble* (Diamond et al., 1997). This task was a visuospatial working memory task. Six different coloured boxes were presented in a line in front of children. They were told there was a sticker hidden in each of the boxes and it was their job to find all the stickers by opening one box at a time. In between each trial the boxes were

scrambled. Therefore, to find all the stickers children had to remember which of the coloured boxes they had already opened. Children were given up to 15 attempts to find all six stickers. Final scores were calculated by taking the total number of attempts required to successfully retrieve all six stickers and subtracting it from 15, which was the maximum number of moves possible. Children's scores ranged from 0-9, and higher scores indicated better visuospatial working memory skills.

*Backwards digit span task* (Wechsler, 2003). This task tested children's complex working memory skills (i.e., central executive and phonological loop, see Baddeley & Logie, 1999). The experimenter stated numbers in sequence to the children; the sequences ranged from 2 to 8 digits in length. Children were asked to repeat the sequences in backward order. For example, the experimenter said 6-2 and children had to repeat the numbers 2-6 back to her. After two correct trials another digit was added to the sequence length making the task more and more difficult. Specifically, this task required children to use their central executive to process and manipulate the numbers said to them as well as required them to rehearse the numbers in their phonological loop to repeat them back to the experimenter. Once children were unable to successfully repeat two sequence s that were the same digit length in a row the task was terminated. Each correct sequence was given a point of 1 and scores for this task ranged from 0-16. Higher scores indicated better complex working memory skills.

## Results

I will begin by describing children's peeking and lie-telling behaviour. Then I will examine differences in lie-telling rates by condition: self-awareness vs. control. I will also examine differences in lie-telling by each social-cognitive and cognitive factor (i.e., theory of mind, inhibitory control, and working memory). Preliminary results showed that there were no significant sex differences, so further analyses were collapsed across sex.

### Peeking Behaviour

Overall, 78% ( $N = 50$ ) of children peeked at the toy (see Table 1). Since the experimental condition (i.e., placing mirror in front of children) did not occur until after children peeked at the toy, no condition differences were expected in terms of peeking behaviours. To examine this, a chi-square test was conducted on the number of children who peeked by condition. There was no significant difference indicating that children in the self-awareness condition (77%) peeked just as often as children in the control condition (79%),  $\chi^2(1, N = 64) = 0.02, p = .90$ . To examine whether there was a difference in the number of children who peeked based on their age, a chi-square test was conducted on the number of children who peeked by age in years,  $\chi^2(3, N = 64) = 5.75, p = .12$ , which revealed children's peeking behaviour did not significantly vary with age. Given that I am particularly interested in children's lie-telling behaviour, only children who peeked at the toy were examined further.

Table 1

Percentage of Children who Peeked and Percentage of Peekers who Lied by Age

	3 Years ( <i>n</i> = 23)	4 Years ( <i>n</i> = 16)	5 Years ( <i>n</i> = 10)	6 Years ( <i>n</i> = 16)	Total ( <i>N</i> = 64)
Peekers	83	88	50	80	78
Lie-Tellers	47	64	60	92	65

### **Initial Lie-Telling Behaviour**

Overall, 65% ( $N = 32$ ) of the children who peeked at the toy lied about it (see Table 1). To examine the effects of age (whether children will be more likely to lie with age) a hierarchical logistic regression was conducted with peekers' answers to the target question "Did you peek?" (0 = Truth, 1 = Lie) as the dependent variable. Children's age in years was entered on the first step. Step 1 of the model was significant,  $\chi^2 (1, N = 50) = 6.18, p = .013$ . As age increased, children were significantly more likely to lie about their transgression,  $\beta = 0.69$ , Wald = 5.14,  $p = .023$  (see Table 1). The odds ratio indicated that with each year increase in age, children were 1.99 times more likely to lie about their transgression.

### **Social-cognitive and Cognitive Factors**

First, I examined the relationship between children's lie-telling behaviours and social-cognitive and cognitive skills (theory of mind and executive functioning). I began by examining descriptives (see Table 2) and correlations (see Table 3) for each social-cognitive and cognitive factor. I also performed t-tests to examine whether truth- and lie-tellers differed in their executive functioning and theory of mind scores (see Table 4). Given that the sample size was relatively small, individual analyses were performed for each of the social-cognitive and cognitive skills.

Regarding the development of children's social-cognitive and cognitive skills and age, as expected, children's scores on some inhibitory control tasks (Bear/Dragon and Delay of Gratification), a working memory task (Backward Digit Span), and the Theory-of-Mind tasks were significantly positively related to age (see Table 3). In contrast, one inhibitory control task (Day/Night Stroop) and one working memory task (Six Box



Scramble) were not significantly related to age. Thus, age was controlled for in regression analyses for social-cognitive and cognitive tasks significantly related to age.

**Theory of mind.** An independent samples t-test was conducted to assess whether First-Order False Belief (IV) related to children's lie-telling behaviours (DV), which revealed truth ( $M = 1.24$ ,  $SD = 1.30$ ) and lie-tellers ( $M = 2.25$ ,  $SD = 1.32$ ) were significantly different on First-Order False Belief scores:  $t(47) = -2.57$ ,  $p = .013$  (see Table 4). Thus, children who lied had higher first-order false-belief scores than truth-tellers.

Given that First-Order False-Belief scores correlated with age (see Table 3), a hierarchical logistic regression was conducted to control for age. Peekers' answers to the target question "Did you peek?" (0 = Truth, 1 = Lie) was used as the dependent variable. Children's age in years was entered on the first step, followed by First-Order False-Belief scores on the second step. Step 1 of the model was significant,  $\chi^2(1, N = 49) = 6.15$ ,  $p = .013$ , indicating that as age increased, children were significantly more likely to lie about their transgression,  $\beta = 0.70$ , Wald = 5.06,  $p = .024$ . Step 2 of the model was not significant,  $\chi^2(1, N = 49) = 1.70$ ,  $p = .192$ . Thus, children's performance on the First-Order False-Belief task did not significantly relate to their lie-telling behaviours above and beyond the contribution of age.

### **Working memory tasks.**

**Six box scramble.** An independent samples t-test was conducted to assess whether children's Six Box Scramble Scores (IV) related to their lie-telling behaviours (DV). Results show that truth ( $M = 6.88$ ,  $SD = 1.99$ ) and lie-tellers ( $M = 7.58$ ,  $SD = 2.49$ ) did not significantly differ on Six Box Scramble Scores:  $t(47) = -1.00$ ,  $p = .32$  (see Table 4).

Thus, scores on the Six Box Scramble task, which measures visuospatial working memory, did not significantly relate to children's decision to lie.

**Backward digit span.** An independent samples t-test was conducted to assess whether children's Backward Digit Span Scores (IV) related to their lie-telling behaviours (DV), which revealed truth tellers ( $M = 1.31$ ,  $SD = 2.06$ ) had significantly lower scores than lie-tellers ( $M = 3.28$ ,  $SD = 2.40$ ):  $t(40) = -2.56$ ,  $p = .014$ ,  $d = -0.88$  (see Table 4). Thus, children who lied had higher complex working memory scores, as measured by Backward Digit Span.

Given that Backward Digit Span scores correlated with age (see Table 3), a hierarchical logistic regression was conducted to control for age. Peekers' answers to the target question "Did you peek?" (0 = Truth, 1 = Lie) was entered as the dependent variable. Children's age in years was entered on the first step, followed by Backward Digit Span scores on the second step. Step 1 of the model was significant,  $\chi^2(1, N = 42) = 3.31$ ,  $p = .069$  ( $p = .035$  one-tailed) indicating that as age increased, children were significantly more likely to lie about their transgression,  $\beta = 0.55$ , Wald = 2.96,  $p = .085$  ( $p = .043$  one-tailed). Step 2 of the model was also significant,  $\chi^2(1, N = 42) = 3.11$ ,  $p = .078$  ( $p = .039$  one-tailed). After controlling for age, as Backward Digit Span scores increased, children trended in the direction of being more likely to lie about their transgression,  $\beta = 0.44$ , Wald = 2.60,  $p = .107$  ( $p = .054$  one-tailed).

#### **Inhibitory control tasks' reliance on working memory.**

To examine the dependence of working memory on each inhibitory control measure (Day/Night Stroop, Bear/Dragon, and Delay of Gratification), correlations among working memory and inhibitory control measures were examined (see Table 3).

Table 2

Overall Range, Mean Scores, (and Standard Deviations) for Theory of Mind and Each Executive Functioning Skills and by Age

	Sample Size ( <i>N</i> )	Range	3 Years	4 Years	5 Years	6 Years	Total
Theory of Mind							
First-Order False-Belief	49	0-4	0.84 (0.96)	2.15 (1.07)	2.60 (1.14)	3.00 (1.28)	1.90 (1.34)
Inhibitory Control							
Day/Night Stroop	48	0-16	9.55 (4.37)	8.84 (5.98)	7.60 (7.30)	11.25 (5.34)	9.58 (5.34)
Bear/Dragon	50	0-5	2.42 (2.32)	4.43 (1.50)	5.00 (0.00)	5.00 (0.00)	3.86 (1.98)
Delay of Gratification (in seconds)	50	0-300	98.81 (119.71)	216.86 (136.51)	240.60 (132.82)	300.00 (0.00)	194.33 (135.22)
Working Memory							
Backward Digit Span	42	0-8	0.25 (0.62)	2.08 (2.25)	5.00 (1.87)	4.75 (1.14)	2.67 (2.45)
Six Box Scramble	49	0-9	7.11 (2.37)	7.57 (1.70)	6.00 (3.74)	7.92 (2.23)	7.33 (2.32)

Table 3

Correlations Among Children's Age (in Years), Theory of Mind and Executive Function Scores

Measure	Age in Years	First-Order False-Belief	Day/Night Stroop	Bear/Dragon	Delay of Gratification	Six Box Scramble
Age in Years						
First-Order False-Belief	.622***					
Day/Night Stroop	.101	.320*				
Bear/Dragon	.521***	.475***	.085			
Delay of Gratification	.579***	.419**	.013	.436**		
Six Box Scramble	.086	-.167	-.025	.034	.250	
Backward Digit Span	.756***	.566***	.046	.437**	.587***	.195

*Note.* \*Correlation is significant at  $p = .05$  level, \*\*Correlation is significant at  $p = .01$  level, \*\*\*Correlation is significant at  $p = .001$  level

Day/Night Stroop was not significantly related to Backward Digit Span task,  $r(41) = .05$ ,  $p = .77$ . Thus, the Day/Night Stroop does not appear to be dependent on working memory. Both the Bear/Dragon task and Delay of Gratification task were significantly positively related to the Backward Digit Span task:  $r(42) = .437$ ,  $p = .004$ ;  $r(42) = .587$ ,  $p < .001$ , respectively. Thus, these seem to be inhibitory control tasks that are working memory dependent. Therefore, the Day/Night Stroop appears to be an inhibitory control task that is less reliant on working memory whereas Bear/Dragon and Delay of Gratification seem to be working memory dependent tasks.

### **Inhibitory control tasks.**

**Day/Night Stroop.** An independent samples t-test was conducted to assess whether Day/Night Stroop Scores (IV) related to children's lie-telling behaviours (DV), which revealed that truth ( $M = 9.18$ ,  $SD = 5.45$ ) and lie-tellers ( $M = 9.81$ ,  $SD = 5.36$ ) did not significantly differ on Day/Night Stroop scores:  $t(46) = -0.39$ ,  $p = .70$  (see Table 4). Thus, scores on the Day/Night Stroop task, a task that does not require working memory, did not significantly relate to children's decision to lie.

**Bear/Dragon.** An independent samples t-test was conducted to assess whether children's Bear/Dragon scores (IV) related to their lie-telling behaviours (DV), which revealed truth tellers ( $M = 2.67$ ,  $SD = 2.47$ ) had significantly lower scores than lie-tellers ( $M = 4.53$ ,  $SD = 1.24$ ):  $t(48) = -3.56$ ,  $p = .001$ ,  $d = -0.95$  (refer to Table 4). Thus, children who lied had higher inhibitory control and working memory skills together as measured by Bear/Dragon.

Given that Bear/Dragon scores correlated with age (see Table 3), a hierarchical logistic regression was conducted to control for age. Peekers' answers to the target

question “Did you peek?” (0 = Truth, 1 = Lie) was used as the dependent variable.

Children’s age in years was entered on the first step, followed by Bear/Dragon scores on the second step. Step 1 of the model was significant,  $\chi^2 (1, N = 50) = 6.18, p = .013$ , indicating that as age increased, children were significantly more likely to lie about their transgression,  $\beta = 0.69$ , Wald = 5.14,  $p = .023$ . Step 2 of the model was also significant,  $\chi^2 (1, N = 50) = 5.03, p = .025$ . After controlling for age, with increased Bear/Dragon scores, children were significantly more likely to lie about their transgression,  $\beta = 0.411$ , Wald = 4.41,  $p = .036$ .

***Delay of gratification.*** An independent samples t-test was conducted to assess whether the length of time waited in the Delay of Gratification task (IV) related to children’s lie-telling behaviours (DV), which revealed truth tellers ( $M = 132.52, SD = 139.42$ ) had significantly lower scores than lie-tellers ( $M = 229.09, SD = 121.56$ ):  $t(48) = -2.56, p = .014, d = -0.74$  (see Table 4). Thus, children who lied had significantly higher inhibitory control and working memory skills together, as measured by Delay of Gratification wait time.

Given that this Delay of Gratification wait times correlated with age (see Table 3), a hierarchical logistic regression was conducted to control for age. Peekers’ answers to the target question “Did you peek?” (0 = Truth, 1 = Lie) was entered as the dependent variable. Children’s age in years was entered on the first step, followed by Delay of Gratification scores on the second step. Step 1 of the model was significant,  $\chi^2 (1, N = 50) = 6.18, p = .013$ . As age increased, children were significantly more likely to lie about their transgression,  $\beta = 0.69$ , Wald = 5.14,  $p = .023$ . However, the second step of the model was not significant,  $\chi^2 (1, N = 50) = 1.58, p = .209$ . Thus, children’s performance

Table 4

Mean Scores (and Standard Deviations) of Theory of Mind and Each Executive Functioning Skill for Truth- and Lie-Tellers

	Truth-Tellers		Lie-Tellers		<i>p</i> -value
Theory of Mind					
First-Order False-Belief	<i>n</i> =17	1.23 (1.30)	<i>n</i> =32	2.25 (1.32)	.013
Inhibitory Control					
Day/Night Stroop	<i>n</i> =17	9.18 (5.45)	<i>n</i> =31	9.81 (5.36)	.700
Bear/Dragon	<i>n</i> =18	2.67 (2.47)	<i>n</i> =32	4.53 (1.24)	.001
Delay of Gratification (in seconds)	<i>n</i> =18	132.52 (139.41)	<i>n</i> =32	229.09 (121.56)	.014
Working Memory					
Backward Digit Span	<i>n</i> =13	1.31 (2.06)	<i>n</i> =29	3.28 (2.40)	.014
Six Box Scramble	<i>n</i> =18	6.88 (1.99)	<i>n</i> =31	7.58 (2.23)	.320

on the Delay of Gratification task did not significantly relate to their lie-telling behaviours above and beyond the contribution of age.

Thus, two inhibitory control tasks that were working memory dependent (Bear/Dragon and Delay of Gratification) significantly related to children's lie-telling; alternatively the inhibitory control task that was not working memory dependent (Day/Night Stroop) was not significantly related to children's lie-telling. However, only the Bear/Dragon task related significantly to children's lie-telling above and beyond the contribution of age.

### **Self-Awareness and Lie-Telling**

**Honesty promotion.** Next, to examine the effects self-awareness on children's honesty a hierarchical logistic regression was conducted with peekers' answers to the target question "Did you peek?" (0 = Truth, 1 = Lie) as the dependent variable. Children's age in years was entered on the first step, followed by condition on the second step and age by condition interaction on the final step. Step 1 of the model was significant,  $\chi^2(1, N = 50) = 6.18, p = .013$ . As age increased, children were significantly more likely to lie about their transgression,  $\beta = 0.69$ , Wald = 5.14,  $p = .023$  (see Table 1). Step 2 of the model was also significant,  $\chi^2(1, N = 50) = 5.52, p = .009$ . Children in the self-awareness condition were significantly less likely to lie than children in the control condition (see Figure 2),  $\beta = -1.82$ , Wald = 5.90,  $p = .015$ . The odds ratio revealed that children in the control condition were 6.21 times more likely to lie than children in the self-awareness condition. The final step of the model was not significant,  $\chi^2(1, N = 50) = 0.01, p = .98$ , suggesting that the influence of condition did not vary with age.

**Theory of mind by condition interaction.** To examine whether there was an interaction between theory of mind and condition (self-awareness vs. control), a



hierarchical logistic regression was conducted with peekers' answers to the target question "Did you peek?" (0 = Truth, 1 = Lie) as the dependent variable. Children's age in years was entered on the first step, followed by condition on the second step and theory of mind scores on the third. The theory of mind by condition interaction was entered on the final step. Step 1 of the model was significant,  $\chi^2 (1, N = 49) = 6.15, p = .013$ . As age increased, children were significantly more likely to lie about their transgression,  $\beta = 0.70$ , Wald = 5.06,  $p = .024$ . Step 2 of the model was also significant,  $\chi^2 (1, N = 49) = 5.98, p = .014$ . Children in the self-awareness condition were significantly less likely to lie than children in the control condition,  $\beta = -1.72$ , Wald = 5.21,  $p = .022$ . The third step of the model was not significant,  $\chi^2 (1, N = 49) = 1.75, p = .185$ , indicating that children's lie-telling did not differ by theory of mind score. The final step of the model was not significant,  $\chi^2 (1, N = 49) = 2.43, p = .119$ , indicating that with increased theory-of-mind scores children's frequency of lying did not vary by condition.

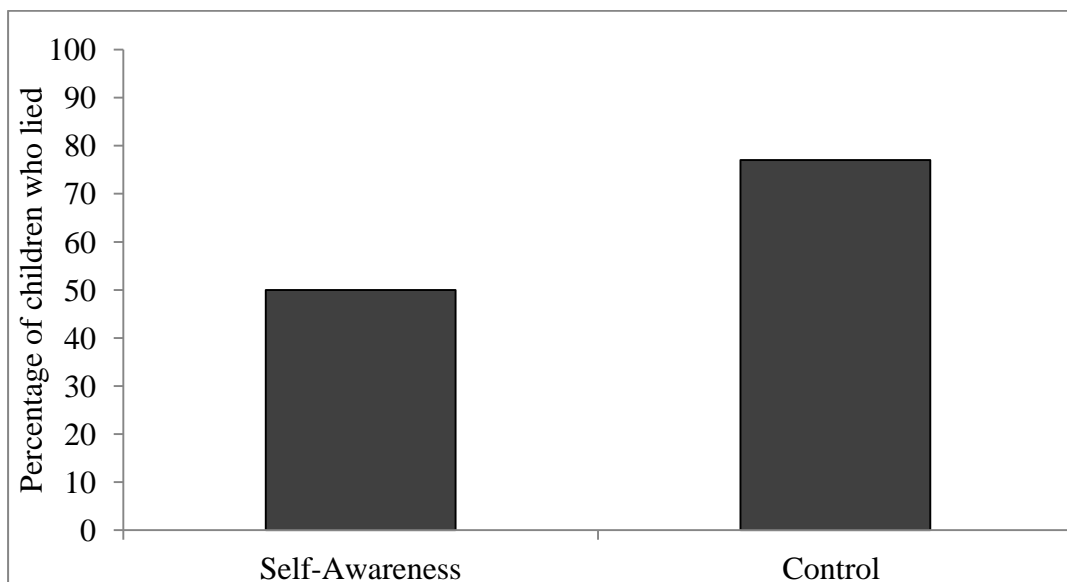


Figure 2: Percentage of children who lied by condition.

## Discussion

The current study investigated the development of lie-telling in 3- to 6-year-old children, how social-cognitive and cognitive development relates to children's lie-telling, as well as the effectiveness of a novel honesty promoting technique. First, I predicted that, consistent with previous literature, children's lie-telling would increase with age (e.g., Lee, 2013). This prediction was supported. In fact, while children told lies across all ages, children were approximately 2 times more likely to lie with each year increase in age according to the odds ratio.

Additionally, this investigation showed that only specific executive functioning skills such as complex working memory and inhibitory control and working memory together significantly related to children's lie-telling; in contrast, first-order false-belief, visuospatial working memory and a task solely measuring inhibitory control did not significantly relate to children's lie-telling. As well, it showed that self-awareness is an effective honesty promoting technique.

### Social-Cognitive and Cognitive Factors

I examined the validity of two theoretical models: ToM<sub>1</sub> Hypothesis (e.g., Polak & Harris, 1999; Talwar & Lee, 2002) and ADCM (Walczyk, et al., 2009), to examine how social-cognitive and cognitive factors relate to the development of lie-telling in children.

**Theory of mind.** It was predicted that the ToM<sub>1</sub> hypothesis would be supported: children with better first-order false-belief scores will be more likely to lie (e.g., Polak & Harris, 1999; Talwar & Lee, 2002). However, this prediction was not supported as performance on the first-order false-belief tasks did not significantly relate to children's lie-telling behaviours above and beyond the contribution of age. This suggests that first-order false-belief may be sufficient, but not necessary, for lie-

telling to occur. Children have not been found to readily pass first-order false-belief tasks until about 4-to 5-years-of-age (e.g., Wimmer & Perner, 1983). However, observational and experimental studies have found that lie-telling emerges in children as young as 2 years (e.g., Evans & Lee, 2013; Newton et al., 2000; Wilson, Smith & Ross, 2003). For example, even 2-year-old children have told lies in a temptation resistance paradigm (Evans & Lee, 2013). Additionally, Newton et al. (2000) showed that 2.5-year-olds lied in an observational study. Furthermore, the prevalence and variety of lies told by these children did not differ depending on whether they passed or failed first-order false-belief tasks. Thus, other factors may also influence the emergence of lie-telling.

The lack of a relationship between first-order false-belief and lie-telling is not surprising. Both non-typical children and children who have grown up in non-typical environments lack theory-of-mind skills, nonetheless these children lie earlier and better than typical children. Talwar and Lee (2011) examined how corporal punishment affected the development of preschoolers' lie-telling and found that although children were matched on cognitive abilities, the preschoolers exposed to corporal punishment were about 12 times more likely to lie in a temptation resistance paradigm vs. those not exposed to corporal punishment. Thus, the punitive environment contributed to these preschoolers developing lie-telling abilities earlier, even though they lacked first-order false-belief. Moreover, Rasmussen, Talwar, Loomes, and Andrew (2008) examined how typically developing children and children with Fetal Alcohol Spectrum Disorders (FASD) developed lie-telling behaviours and found that children with FASD lied more often and earlier than their typically developing matched counterparts, despite the fact that they should have poorer social-cognitive abilities (i.e., Theory of Mind). Children with FASD tend to

engage in more transgressions and delinquent behaviour that might require them to learn to lie earlier and more often as a means to conceal these actions. Thus, despite lacking theory-of-mind skills children who grew up in a punitive environment and children with FASD both lied more often and earlier than typically developing children, so theory-of-mind may be sufficient but not necessary for lie-telling.

**Working memory.** Next, I also tested the effectiveness of the ADCM (Walczyk et al., 2009) by examining how executive functions related to lie-telling by looking at the contributions of working memory, inhibitory control, and how a combination of these two skills would relate to lie-telling. Specifically, I examined how different components of working memory related to children's lie-telling. Consistent with the ADCM I expected complex working memory, which is comprised of the phonological loop and central executive, but not visuospatial working memory, to relate to children's lie-telling. In support of this hypothesis, the complex working memory measure, Backward Digit Span, trended in the direction of being significantly and positively related to lie-telling while the visuospatial measure (Six Box Scramble) was not significantly related. According to the ADCM, complex working memory should relate to children's lie-telling because to lie you must hold the truth in the working memory store, which should involve rehearsal (i.e., phonological loop) while simultaneously constructing a lie, which should involve processing the truth to make up a lie (i.e., central executive). However, the reason there is only a trend instead of this being a statistically significant result might be due to the limited sample size of the present study. With increased sample size I expect this trend to become significant. Future studies should examine this with larger sample sizes to assess if this trend does become significant. One other study examined 3- to 8- year-old children's working memory and lie-telling and did not find a

significant relationship between the two factors, using a visuospatial working memory task (Talwar & Lee, 2008); thus, the current study's findings, along with previous studies, suggests that lie-telling in the temptation resistance paradigm does not rely on visuospatial processing but rather requires complex working memory. Additionally, in the present investigation children's scores on the Six Box Scramble task scores did not vary with age, so in general this task may not be a good measure of children's working memory.

**Working memory and inhibitory control.** Finally, it was predicted that inhibitory control in combination with working memory would relate to children's lie-telling, but that inhibitory control on its own would not (e.g., Talwar & Lee, 2008). To examine this, I looked at the measures of inhibitory control and how they related to working memory. Since the Day/Night Stroop task was not significantly related to working memory it is a more pure inhibitory control measure. This more pure measure of inhibitory control did not significantly relate to children's lie-telling in the present study, providing support for the idea that inhibitory control alone is not sufficient for children's lie-telling. Additionally, the prediction that the combination of inhibitory control and working memory would relate to lie-telling was partially supported. The Bear/Dragon task predicted children's lie-telling above and beyond age ( $\beta = 0.411$ , Wald = 4.41,  $p = .036$ ), but the Delay of Gratification task did not. It has been suggested that executive functioning tasks can differ in terms of "hot" vs. "cool" elements. For example, cool tasks are said to be more abstract, requiring less of a motivational or affective component compared to hot tasks, which involve emotionally significant consequences or motivation through gains/losses (e.g., Zelazo & Carlson, 2012). Since the Delay of Gratification task involves an external motivator (i.e., snack treats) it might be more of a "hot" executive functioning task compared to

the Bear/Dragon which has no external motivator. Future research should examine how this “hot” vs. “cool” distinction for executive functions relates to children’s lie-telling. According to the ADCM, inhibitory control in combination with working memory should relate to children’s lie-telling because to lie you must hold the truth in working memory and manipulate this truth into a lie, while simultaneously suppressing the truth to state the lie. In support of this, the present findings suggest that inhibitory control only relates to lie-telling when in combination with working memory.

### **Self-Awareness as an Honesty Promoting Technique**

I also aimed to examine the effectiveness of a novel honesty promoting technique: self-awareness. Given that children’s moral transgressions are reduced by becoming self-aware (Beaman et al., 1979) and self-awareness seems to relate to adherence to social norms (Rochat et al., 2012), I predicted that inducing self-awareness would increase honesty due to increasing adherence to the social norms of honesty. This prediction was supported: significantly fewer children in the self-awareness condition (50%) lied than in the control condition (77%). Thus, self-awareness is an effective honesty promoting technique.

Further, I predicted that theory-of-mind understanding would interact with condition (i.e., control vs. self-awareness). It was expected that children in the self-awareness condition who had higher first-order false belief scores would be less likely to lie than children in the control condition with higher first-order false belief scores. This prediction was not supported ( $\chi^2(1, N = 49) = 0.98, p = .323$ ). However, the non-significant finding here could be due to the age range used in the present study. It is not until about age 6 that children begin advancing in theory-of-mind understanding and gain second-order false-belief understanding (e.g., Perner & Wimmer, 1985).

Older children, with second-order false-belief, may be more impacted by the social awareness and adherence to social norms induced by the mirror than children with only first-order false-belief understanding because they have a more advanced social understanding. This is because with second-order false-belief understanding children are capable of dealing with multiple iterations in thought between themselves and another person; thus, children with second-order false-belief can think about how the experimenter would feel, as well as what the experimenter would think about themselves, if they had lied; conversely, younger children cannot make this connection, they can only understand that others can have different beliefs than themselves.

### **Implications, Limitations, and Future Directions**

The present study has some theoretical implications for understanding the mechanisms behind children's moral development. First, self-awareness reduced transgression rates in previous studies with children (e.g., Beaman et al., 1979) and increased honesty in the present study. Thus, self-awareness is a potential underlying mechanism in children's moral development. In addition, no study to date has attempted to parse apart different executive functioning skills to look at potential individual contributors to the development of lie-telling. The present study suggests that visuospatial working memory and inhibitory control alone do not seem to be significantly related to lie-telling. On the other hand, complex working memory as well as inhibitory control and working memory collectively relate to children's lie-telling. However, to further examine the contributions of the inhibitory control measures, a larger sample size is needed to get enough power to assess the contribution of each individual executive functioning factor in a regression analysis.

Practically, this study also has implications for improving children's honesty. For example, very few studies have actually examined honesty promoting techniques and been found to be effective in improving honesty rates (e.g. Lyon & Dorado, 2008; Lyon et al., 2014; Talwar, et al., 2002). This study has discovered a novel technique than can be used to effectively increase children's honesty. The use of a mirror to induce self-awareness could be used as a tool by parents and teachers for moral education programs. Additionally, children often testify in court (Bruck, et al., 1998) or provide evidence in forensic interviews. Thus, children's honesty is vital to the success of the legal system: protecting both children and the accused from dishonest accounts. This technique has the ability to be easily implemented into forensic interviews. For example, there are often one way mirrors in interview rooms. Interviewers would simply have to adjust their setup to have children face the mirror in the room during questioning. Further, the mirror technique would be inexpensive to implement, even if the room is not yet equipped with a mirror. This technique could also potentially be used when children, and possibly even adults, testify in court by placing a mirror in the courtroom for the witness to see their own reflection while testifying. Future studies need to examine the impact of the presence of a mirror on jurors perceptions honesty and the possible effectiveness of honesty promotion with adult witnesses.

There are also several limitations to the present investigation. First, it had a limited sample size. Due to the nature of the temptation resistance paradigm, only children who turned around and peeked at the toy ( $N=50$ ) could be examined in terms of being either truth- or lie-tellers. Further, the sample size was limited in a few ways. First, it was limited in terms of testing only children from ages 3 to 6 years. After this age children continue developing theory-of-mind (i.e., second-order false-belief), and



executive functioning skills, both of which are shown to be related to older children's lie-telling behaviours (e.g., Evans & Lee, 2011; Talwar & Lee, 2008). Secondly, the 5-year-old peeker group consisted of very few children ( $N=5$ ). In the future, it is planned to include a larger sample size in terms of age span as well as within each age group.

Another limitation is that the social-cognitive and cognitive factors (theory of mind and executive functioning) were all correlational. Thus, I can only conclude that inhibitory control in conjunction with working memory, and complex working memory, related to children's lie-telling development; causal conclusions cannot be made about these factors. Future studies should experimentally manipulate executive functioning demands during lie-telling to assess if taxing specific executive functioning skills hinder children's lie-telling ability. Similarly, the present investigation was cross-sectional. Future studies should longitudinally assess the development of lie-telling in children across childhood to allow for an examination of whether there are individual differences in children's lie-telling behaviour. For example, longitudinal studies starting prior to the development of some social-cognitive and cognitive skills can show the progression of the development of these skills within a child along with their progression of lie-telling behaviours.

Furthermore, other possible factors, both social and cognitive, that influence children's honesty need to be assessed. Currently only one study has examined how parenting styles relate to children's lie-telling. Poplinger, Talwar and Crossman (2011) examined how parenting styles affect prosocial lie-telling; however no study to date has examined how parenting styles relate to children's antisocial lie-telling. It is possible that parenting style influences both the frequency and quality of children's lies. For example, permissive parenting is associated with children having poorer

theory-of-mind (Guajardo, Snyder & Petersen, 2009) and reduced self-control (Bornstein, 2002). Authoritarian parenting is associated with children having hindered theory-of mind development, whereas authoritative parenting is associated with children having better false-belief understanding (Ruffman, Perner & Parkin, 1999). Taken together, these findings would suggest that children of authoritative parenting might have an advantage when it comes to lie-telling, whereas children with either permissive or authoritarian styles would potentially have difficulty. Future studies should examine how parenting styles relate to children's antisocial lie-telling.

In terms of unexamined cognitive skills, one study has examined how planning ability relates to lie-telling, but examined 8- to 16-year-olds (Evans & Lee, 2011). No study has examined planning ability in terms of lie-telling in children under the age of 8. Theoretically lie-telling should require planning. For example, to lie, one should have to plan to decide whether lying is appropriate in a given situation. Additionally, planning should be necessary to ensure there is consistency between deceptive statements. Thus, planning could be another executive functioning skill that is related to younger children's lie-telling. Evans and Lee (2011) found that children's planning ability was not related to their decision to lie, but children with better planning abilities were better able at concealing incriminating evidence they ought to not know after denying a transgression they completed. Nonetheless, by the age of 8, children already have established lie-telling abilities (e.g., Evans & Lee, 2011; Talwar, et al., 2007; Talwar & Lee, 2008), so deciding to lie may no longer tax their planning skills; whereas, younger children may have to rely more heavily on their ability to plan whether lying in particular situation is appropriate. Thus, future studies should examine other executive functioning skills, such as planning ability, and how they relate to young children's lie-telling.

Given that previous studies have found social-cognitive skills, cognitive skills (e.g., Evans & Lee, 2011; Evans & Lee, 2013; Talwar, et al., 2007; Talwar & Lee, 2002; Talwar & Lee, 2008) and parenting styles (Poplinger et al., 2011) relate to children's lie-telling behaviours, future studies should examine if these factors also relate to the effectiveness of honesty promoting techniques. For example, authoritative parenting seems to foster the development of conscience in children whereas authoritarian parenting tends to undermine the development of guilt (Kochanska & Aksan, 2006). Due to this, certain honesty promoting techniques may work better with children of parents with authoritative vs. authoritarian parenting styles.

Finally, since no honesty promoting technique to date has eliminated children's lie-telling, future studies should combine effective honesty promoting techniques (e.g., asking children to promise to tell the truth while inducing self-awareness) to see if they are more effective in combination than on their own.

Overall, the present investigation provides insight into the development of children's lie-telling behaviours in terms of social-cognitive and cognitive development as well as an honesty promoting technique. The results demonstrate that the frequency with which children tell lies increases with age. Additionally, the present investigation showed that although first-order false-belief understanding, inhibitory control, and visuospatial working memory did not significantly relate to children's lie-telling, measures of inhibitory control and working memory together as well as complex working memory were significantly related to children's lie-telling. In addition, it provides a novel honesty promoting technique, self-awareness, that can be easily used by parents, teachers, and the legal system.

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